Women in Science and Engineering: EXPLORING WHAT AMAZES US

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National Science Foundation

Women in Astronomy and Space Science 2009
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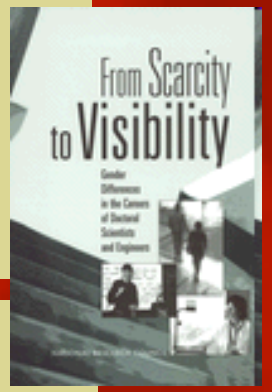
Solving the Maze – "Are we there yet?"



- National Research Council
  - From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers (2001)
  - Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (2006)
  - Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty (2009)
  - More. See…
    - Committee on Women in Science, Engineering and Medicine
    - Committee on Science, Engineering and Public Policy

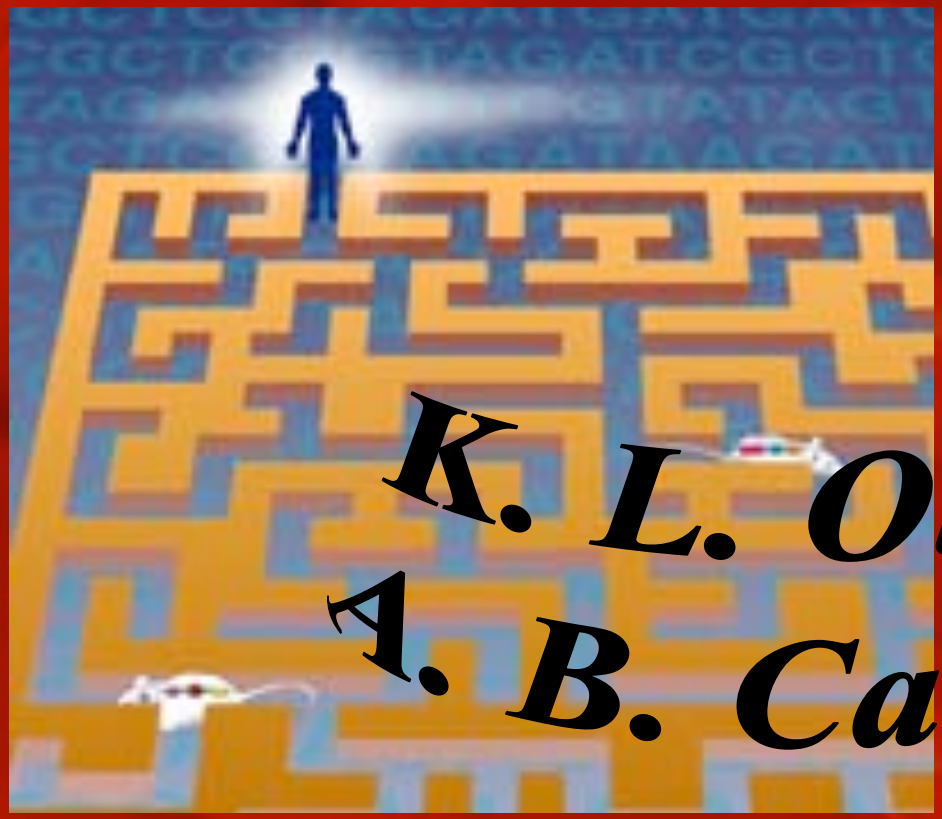
Solving the Maze – "Are we there yet?"

- Federal Agencies
  - NSF
    - Women, Minorities and Persons with Disabilities in Science and Engineering (2009 – published biennially since 1982)
    - Gender Differences in the Careers of Academic Scientists and Engineers (2003)
    - Thirty-Three Years of Women in S&E Faculty Positions (2008)
  - NIH
    - Women in Biomedical Research: Best Practices for Sustaining Career Success (2008: workshop report)
    - National Leadership Workshop on Mentoring Women in Biomedical Careers (2007: workshop report)
  - NSF, NIH, DOE
    - Workshop on Building Strong Academic Chemistry Departments Through Gender Equity (2006: workshop report)

Solving the Maze – "Are we there yet?"

- Other
  - Nepotism and Sexism in Peer Review (Wennerås and Wold, Nature 387/22, 1997)
  - Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering and Technology (2000, Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development—*Morella Commission)*
  - The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed (S.V. Rosser, Routledge, 2004)
  - She Figures 2006: European Commission statistics
  - Many more!

Why Can't we Break Out of the Maze?



K. L. Olsen
A. B. Carlson

One Path at a Time

Unconscious Bias: Hiring and Promotion

- Both men and women are significantly more likely to rank a perceived man higher than a perceived woman, using identical resumes.
  - Fidell, L. S. (1970). *Amer. Psych.* 25, 1094-1098.
  - Steinpreis, R.E., Ritzke, D., and Anders, K.A. (1999). *Sex Roles, 41*, 509-528.

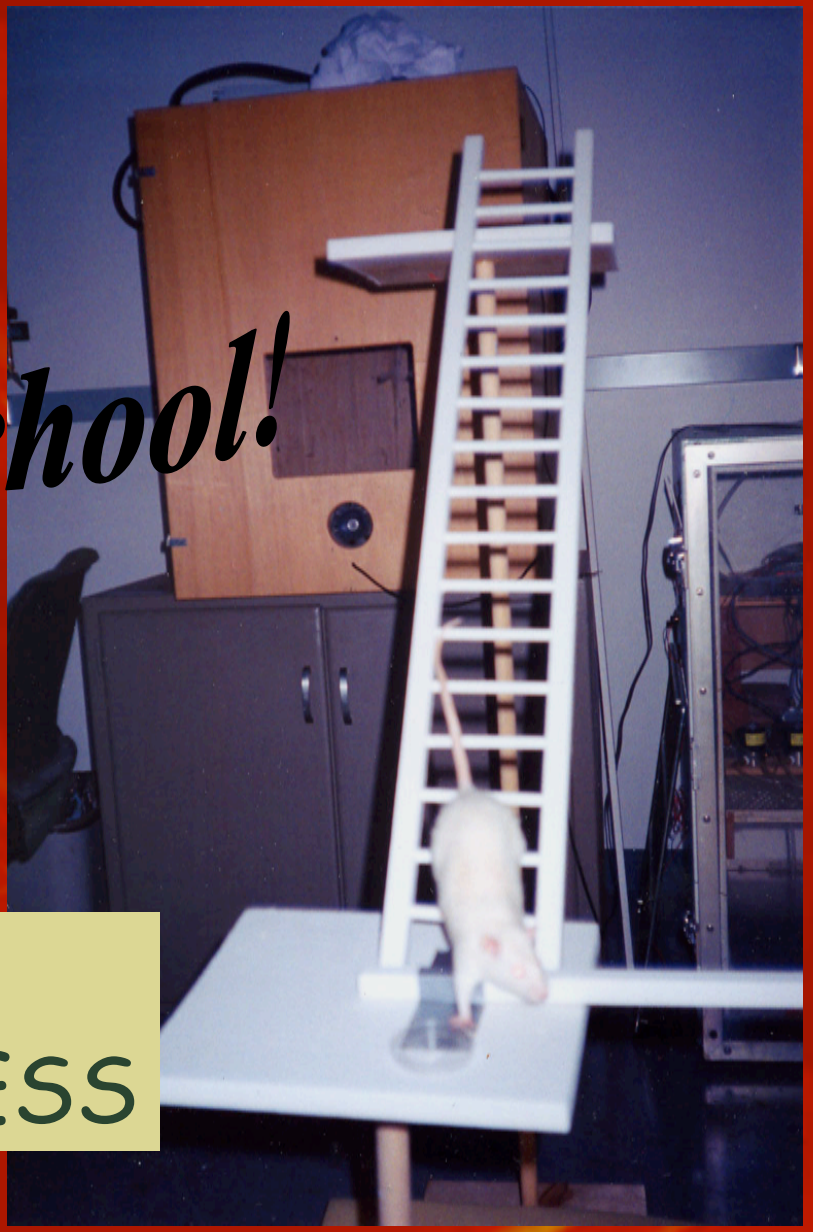
Unconscious Bias: Impact of Blind Auditions

- Based on audition records of 14,000 individuals & rosters from symphony orchestras: 1970-1996:
- The audition data show the use of a screen
  - increases the probability that a woman will advance from preliminary rounds by 50%
- The roster data show the switch to blind auditions
  - accounts for 30% of the increase in the proportion of women among new hires

Goldin & Rouse (2000) *The American Economic Review*, 90, 4, 715-741.

Why Can't we Break Out of the Maze?

My High School!



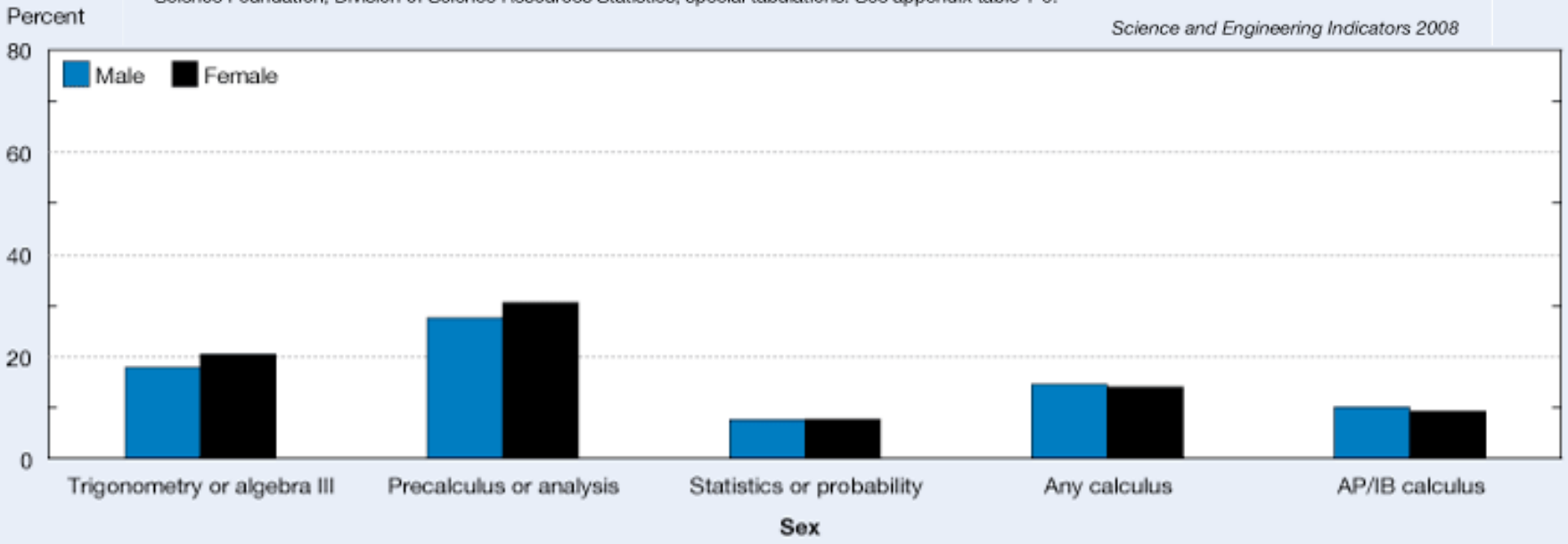
One Path at a Time
WE HAVE MADE PROGRESS

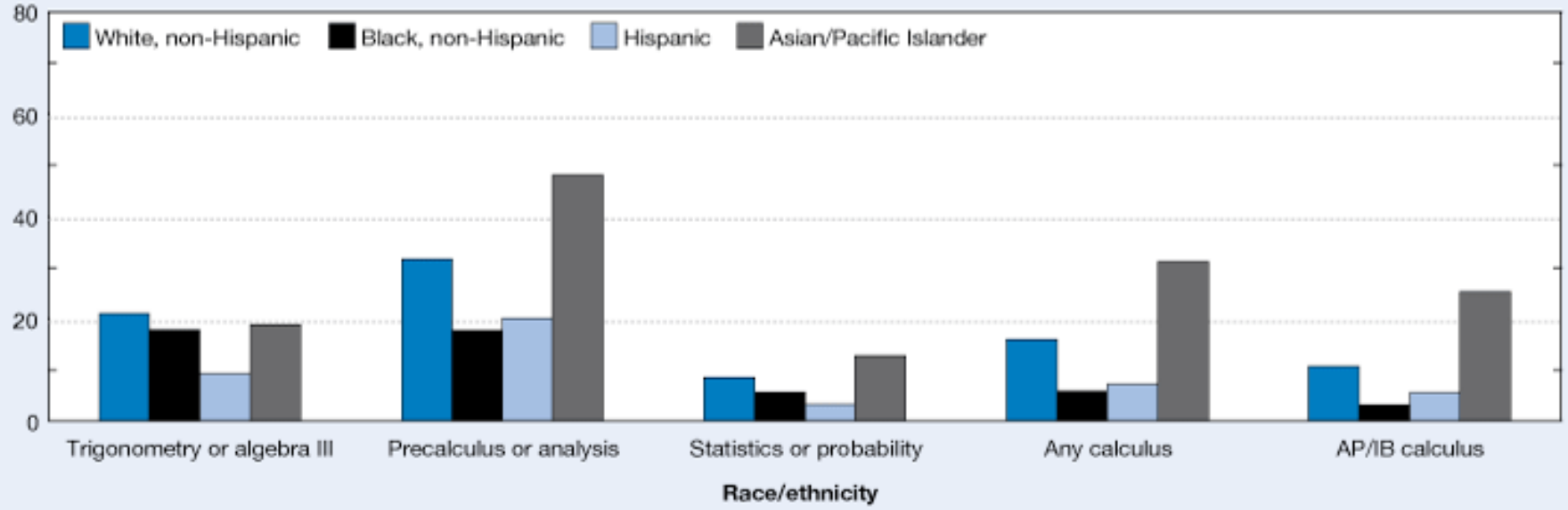
Education Pipeline: Advanced Math Courses

High school graduates completing advanced mathematics courses, by sex and race/ethnicity: 2005

SOURCES: National Center for Education Statistics, National Assessment of Educational Progress, 2005 High School Transcript Study; and National Science Foundation, Division of Science Resources Statistics, special tabulations. See appendix table 1-9.

Science and Engineering Indicators 2008





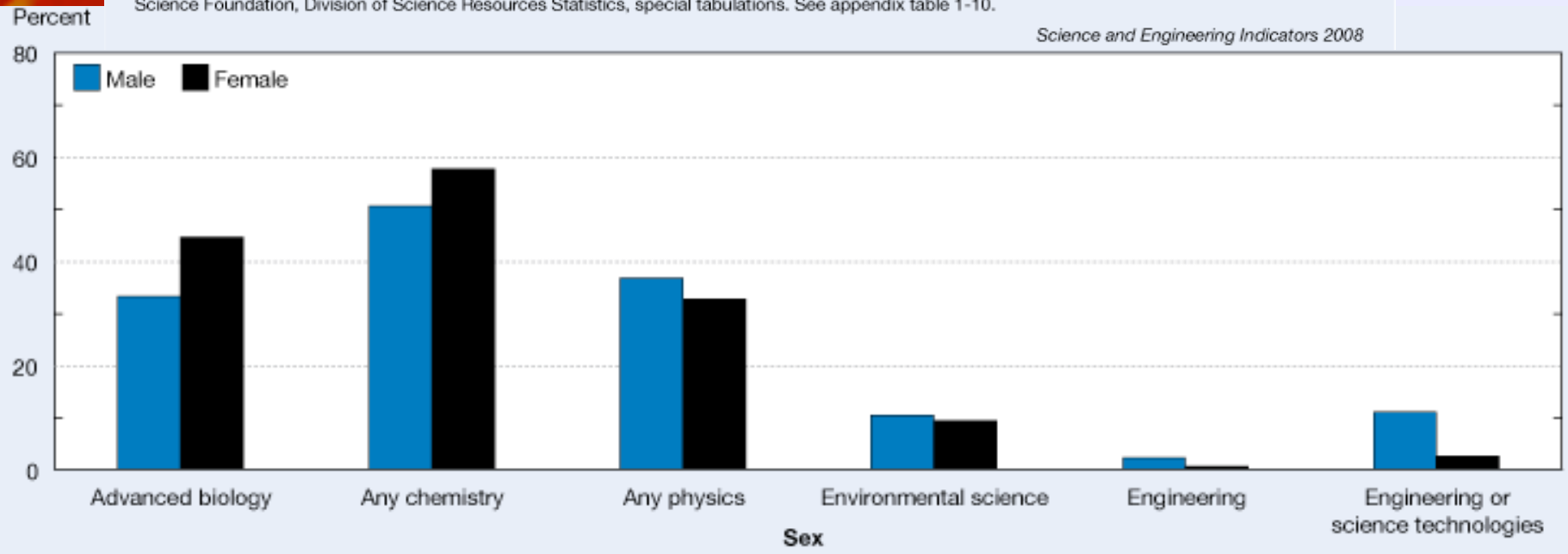
AP = Advanced Placement; IB = International Baccalaureate.

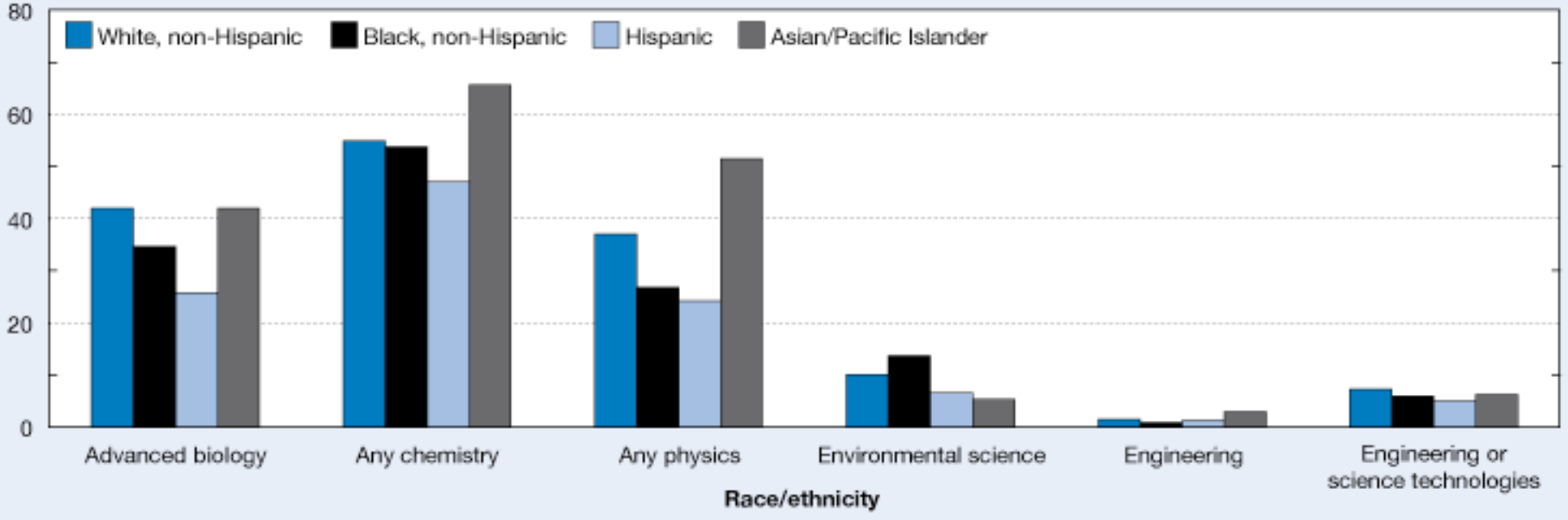
Education Pipeline: Advanced S&E Courses

High school graduates completing advanced S&E courses, by sex and race/ethnicity: 2005

SOURCES: National Center for Education Statistics, National Assessment of Educational Progress, 2005 High School Transcript Study; and National Science Foundation, Division of Science Resources Statistics, special tabulations. See appendix table 1-10.

Science and Engineering Indicators 2008

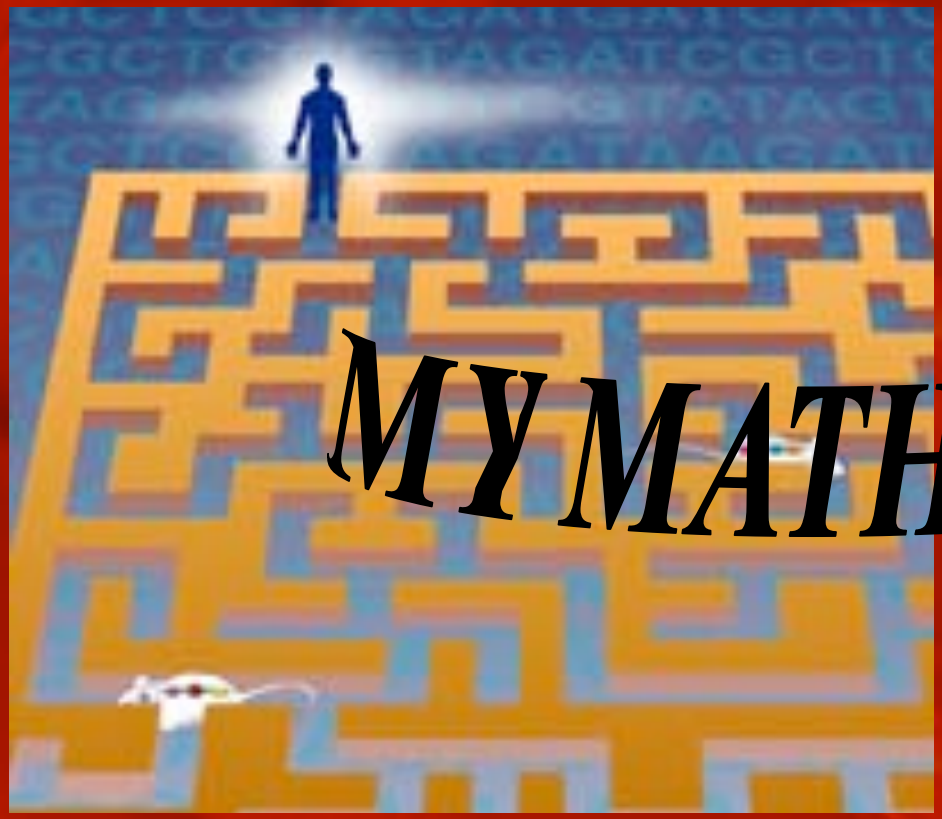




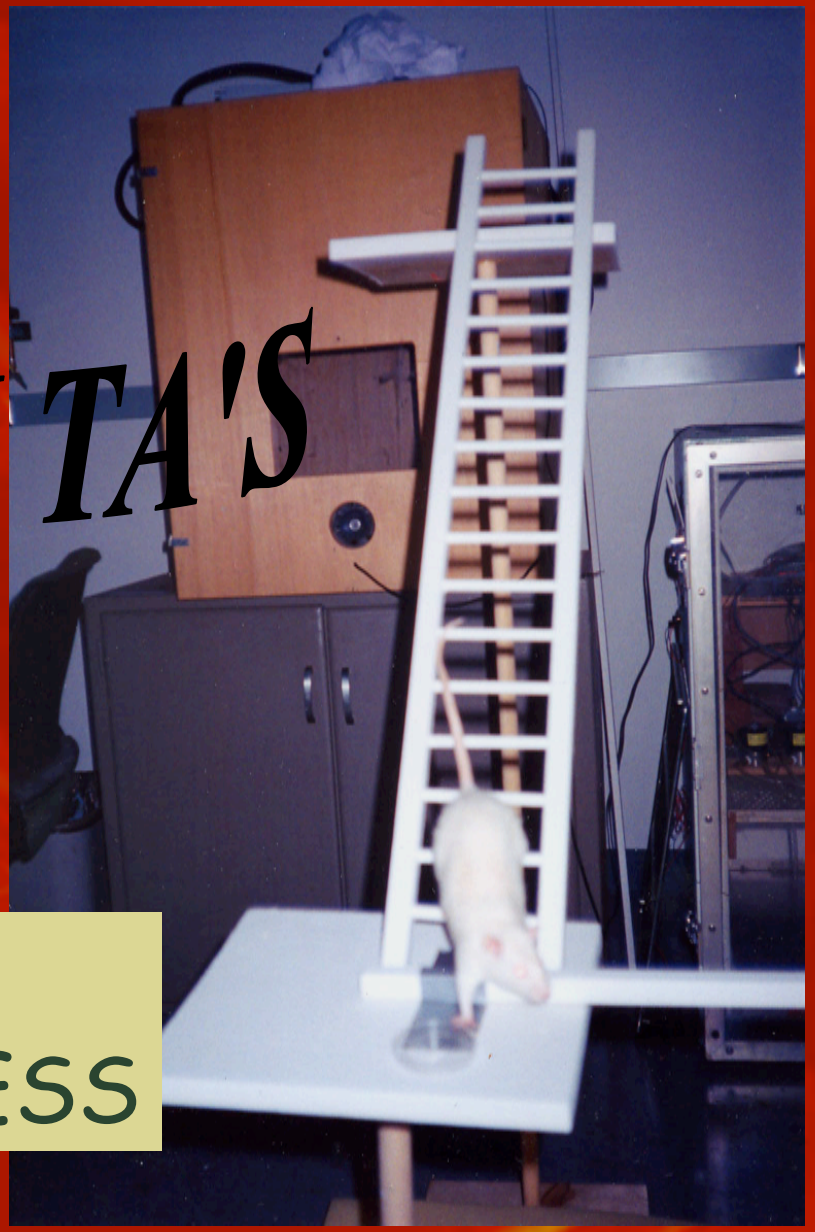
Freshman Year!

- About 25-30% of students entering college intend to major in S&E field
  - Fewer than 50% of those intended complete S&E degree in five years
- Preparation of those interested in S&E study
  - 20% need remediation in math
  - 10% need remediation in science

Why Can't we Break Out of the Maze?



MY MATH TA'S



One Path at a Time
WE HAVE MADE PROGRESS

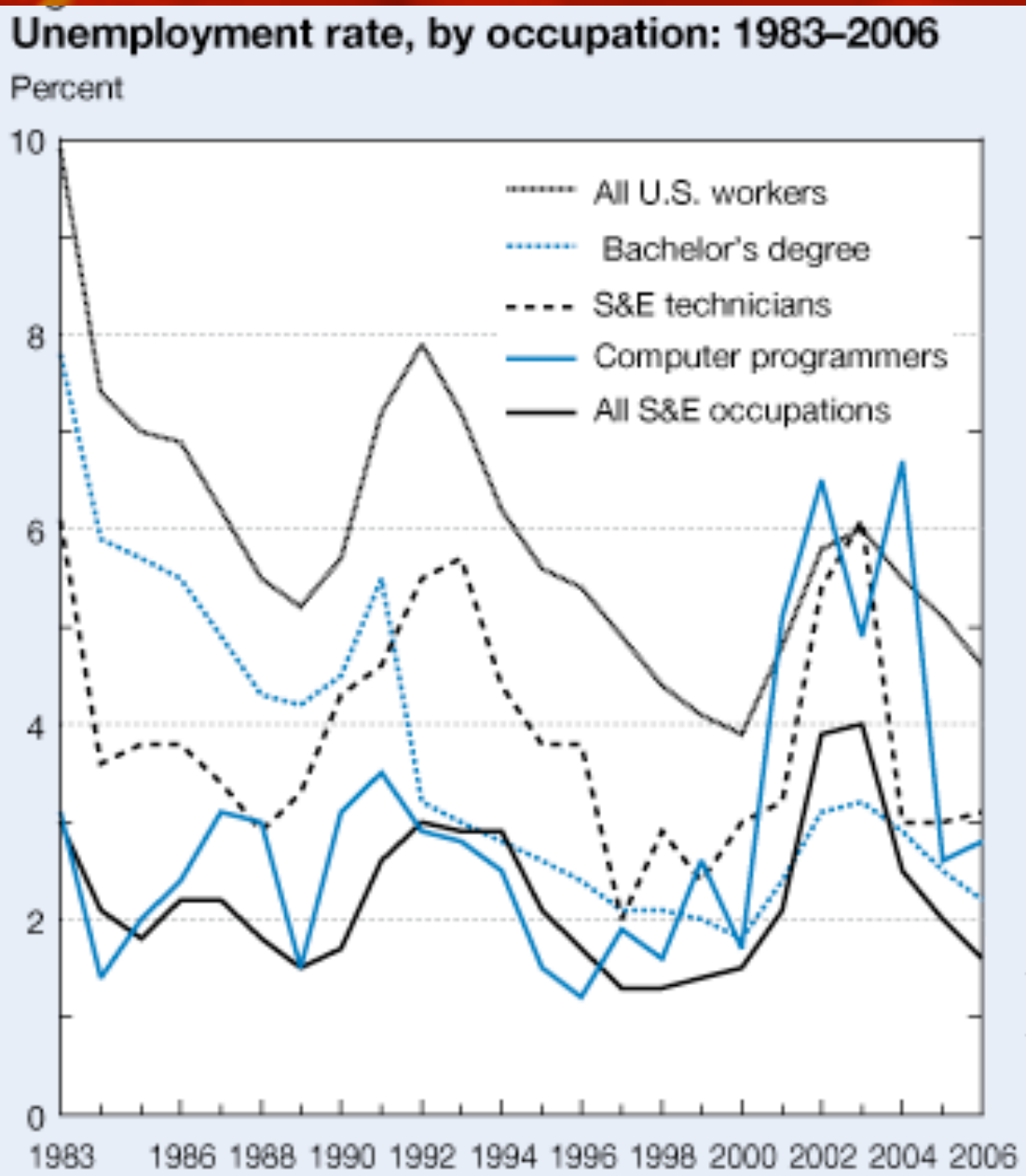
Perceptions Matter!

- FACULTY: Where are my role models?
- "Can I see myself as a scientist or engineer?"
- "What kind of job can I get if I major in science or engineering?"
- The messages that female students receive shape their choices!

Why Can't we Break Out of the Maze?

One Path at a Time
Because
SCIENCE & ENGINEERING
IS A GREAT CAREER

S&E Unemployment Rates Usually Lower than Overall Rate



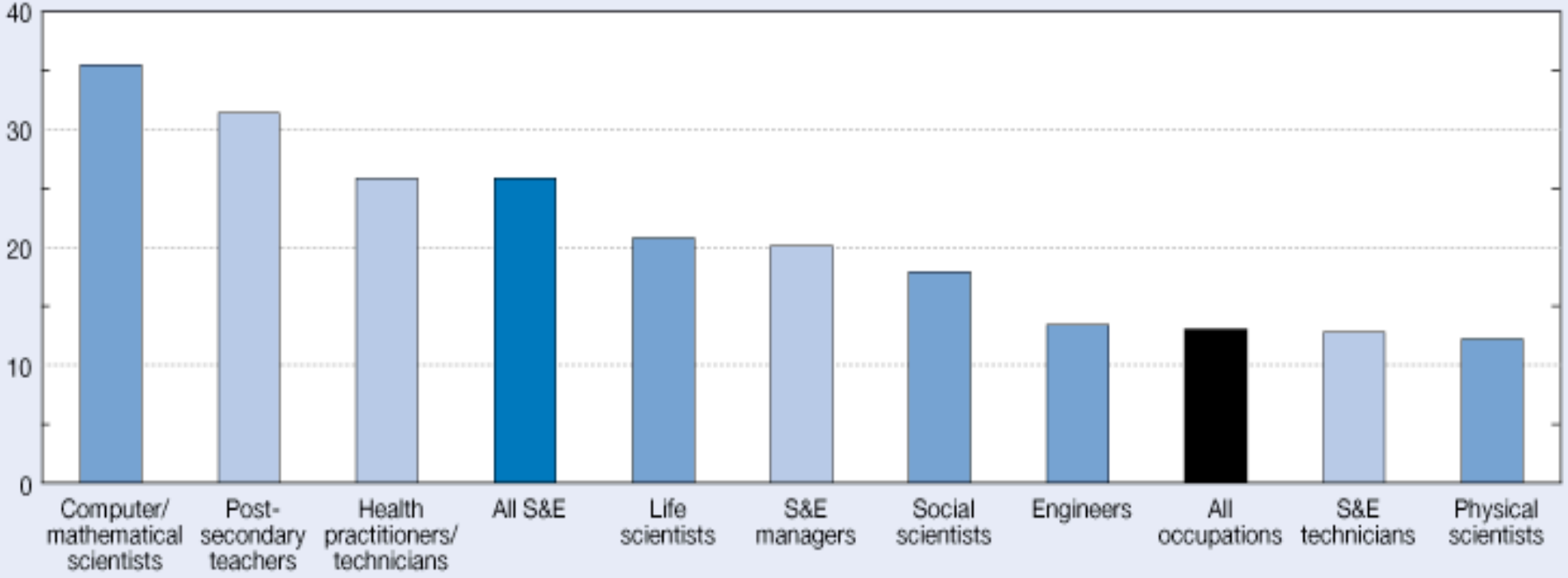
SOURCE: National Bureau of Economic Research, Merged Outgoing Rotation Group Files; Bureau of Labor Statistics, Current Population Survey.

Science and Engineering Indicators 2008

Increased Demand for Highly Skilled Workforce

Even in times of economic uncertainty, S&E jobs will continue to be in-demand, especially in the energy sector

Projected increase in employment, for S&E and selected other occupations: 2004–14

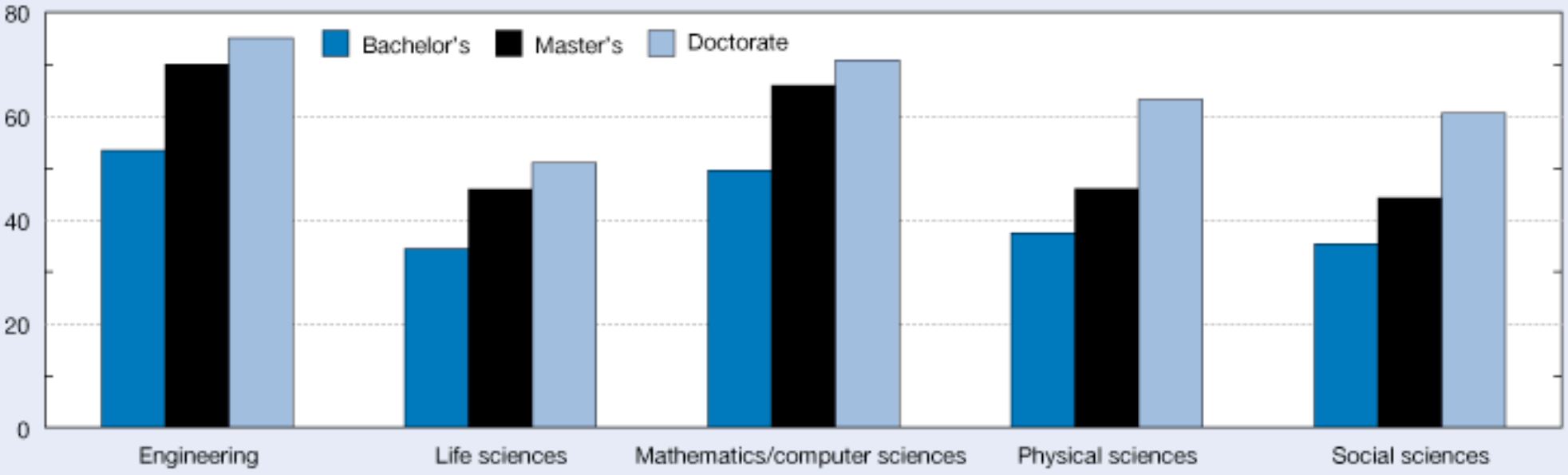


SOURCE: Bureau of Labor Statistics, Office of Occupational Statistics and Employment Projections. See appendix table 3-7.

Science and Engineering Indicators 2008

Mean Annual Salaries of S&E Degree Holders 1-5 Years After Degree

Figure 3-8
Mean salaries of S&E and S&E-related degree recipients 1–5 years after degree, by field and level of highest degree: 2003



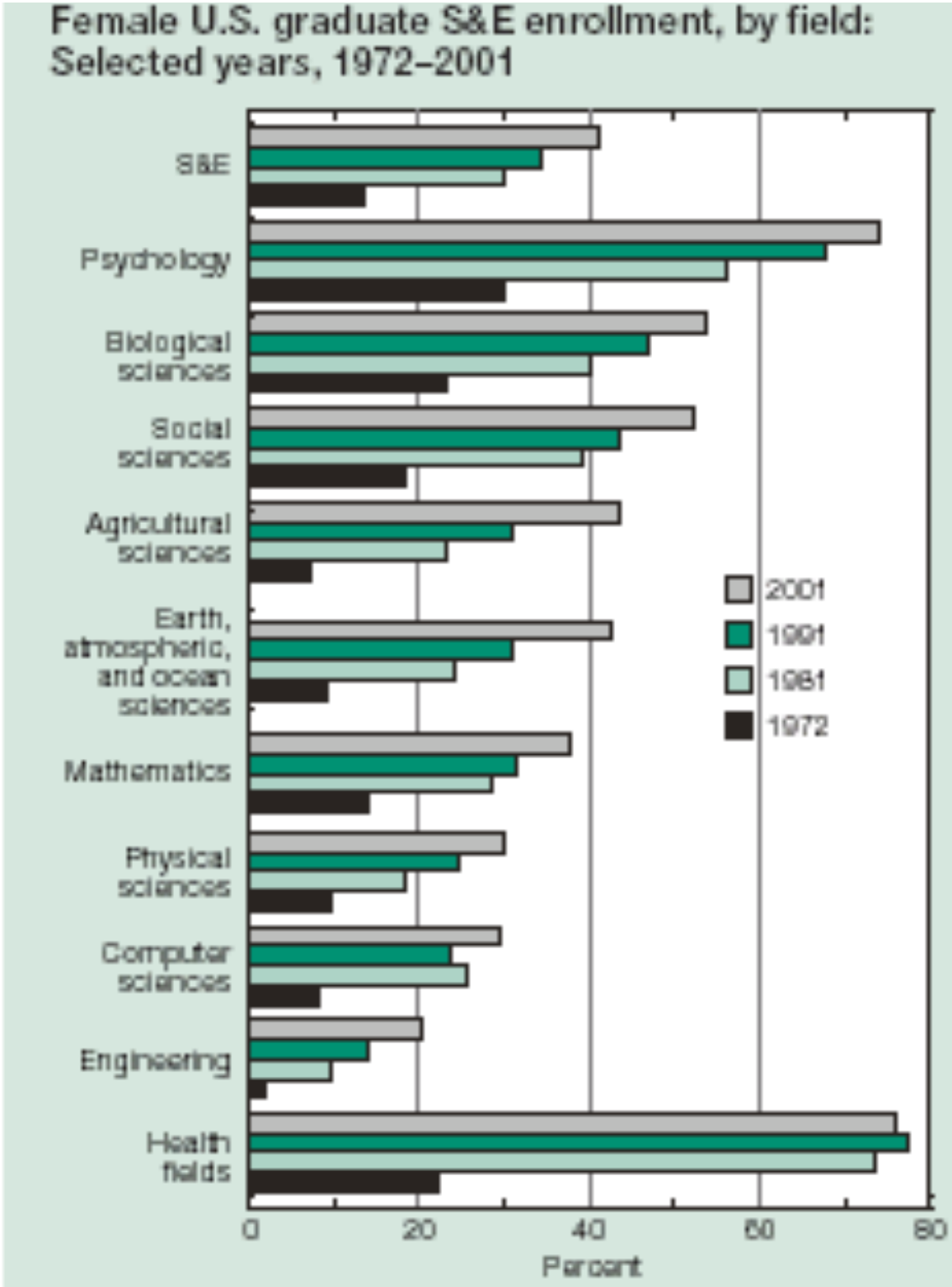
SOURCE: National Science Foundation. Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT), 2003, http://sestat.nsf.gov.

Science and Engineering Indicators 2008

Women & Minorities are underrepresented in science & engineering workforce

- In 2001, women were approximately 40% of the workforce but less than 20% of the S&E workforce
- Minorities were approximately 10% of the workforce but represented about 5% or less of the S&E workforce

Source: Council on Competitiveness *US Competitiveness 2001*



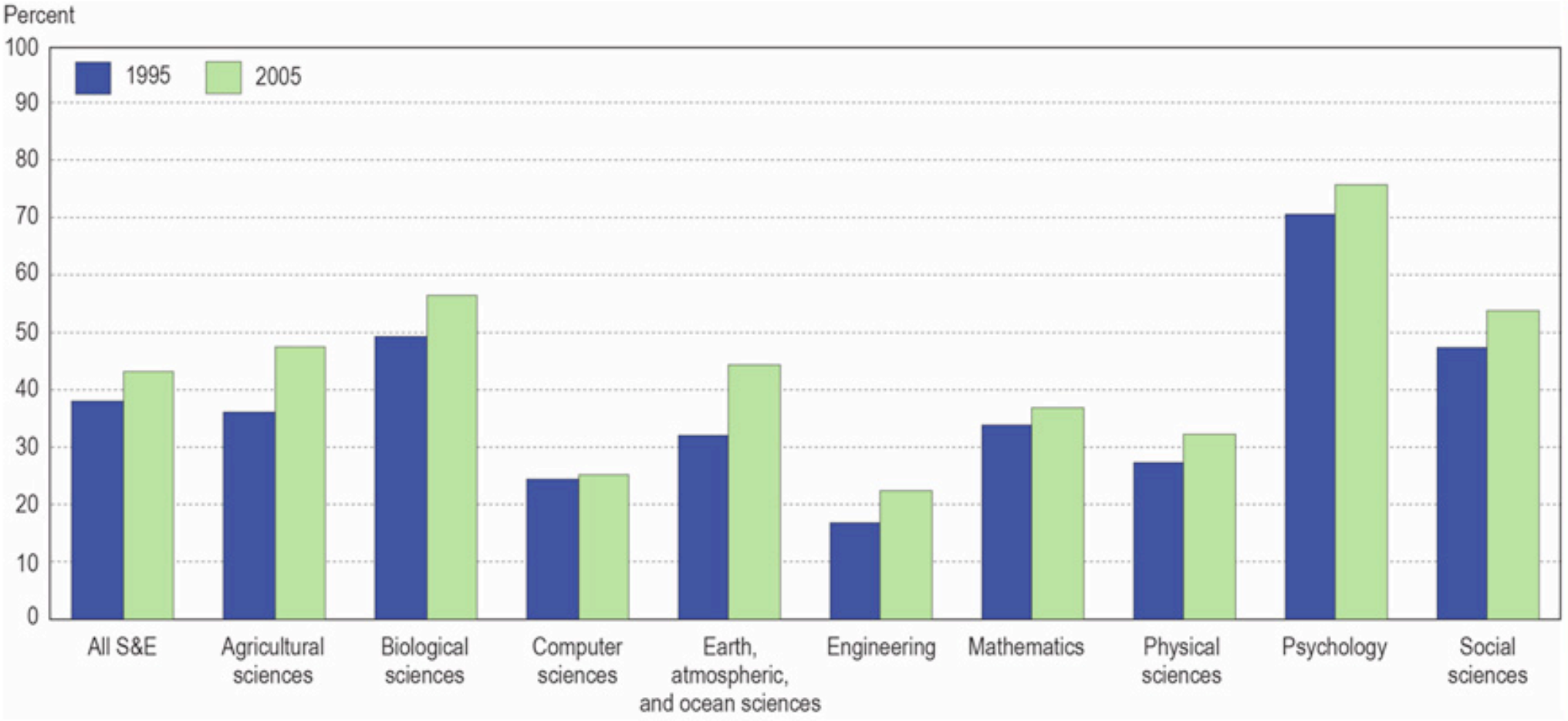
Representation of women in US graduate programs by field of science 1972-2001

NOTE: Health fields not included in S&E total.

SOURCE: National Science Foundation, Division of Science Resources Statistics, WebCASPAR database system, http://caspar.nsf.gov. See appendix table 2-13.

Science & Engineering Indicators – 2004

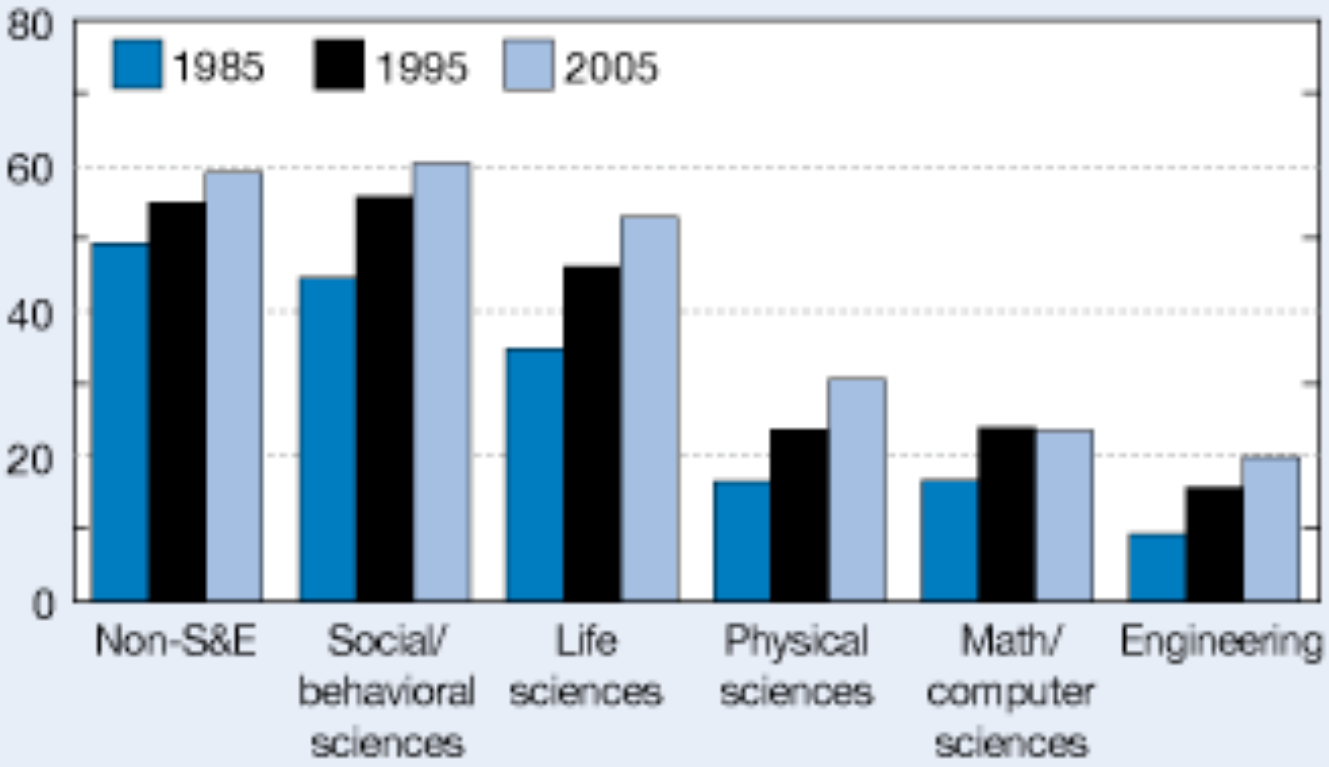
Female S&E graduate students: 1995 and 2005



Source: National Science Foundation, Division of Science Resources Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 1995 and 2005.

Doctoral Degrees Earned by Women
1985, 1995, 2005

U.S. citizen female share of doctoral degrees, by field: 1985, 1995, and 2005



NOTES: Physical sciences include earth, atmospheric, and ocean sciences. Life sciences include biological sciences, agricultural sciences, and medical/other life sciences.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates, WebCASPAR database, http://webcaspar.nsf.gov. See appendix table 2-31.

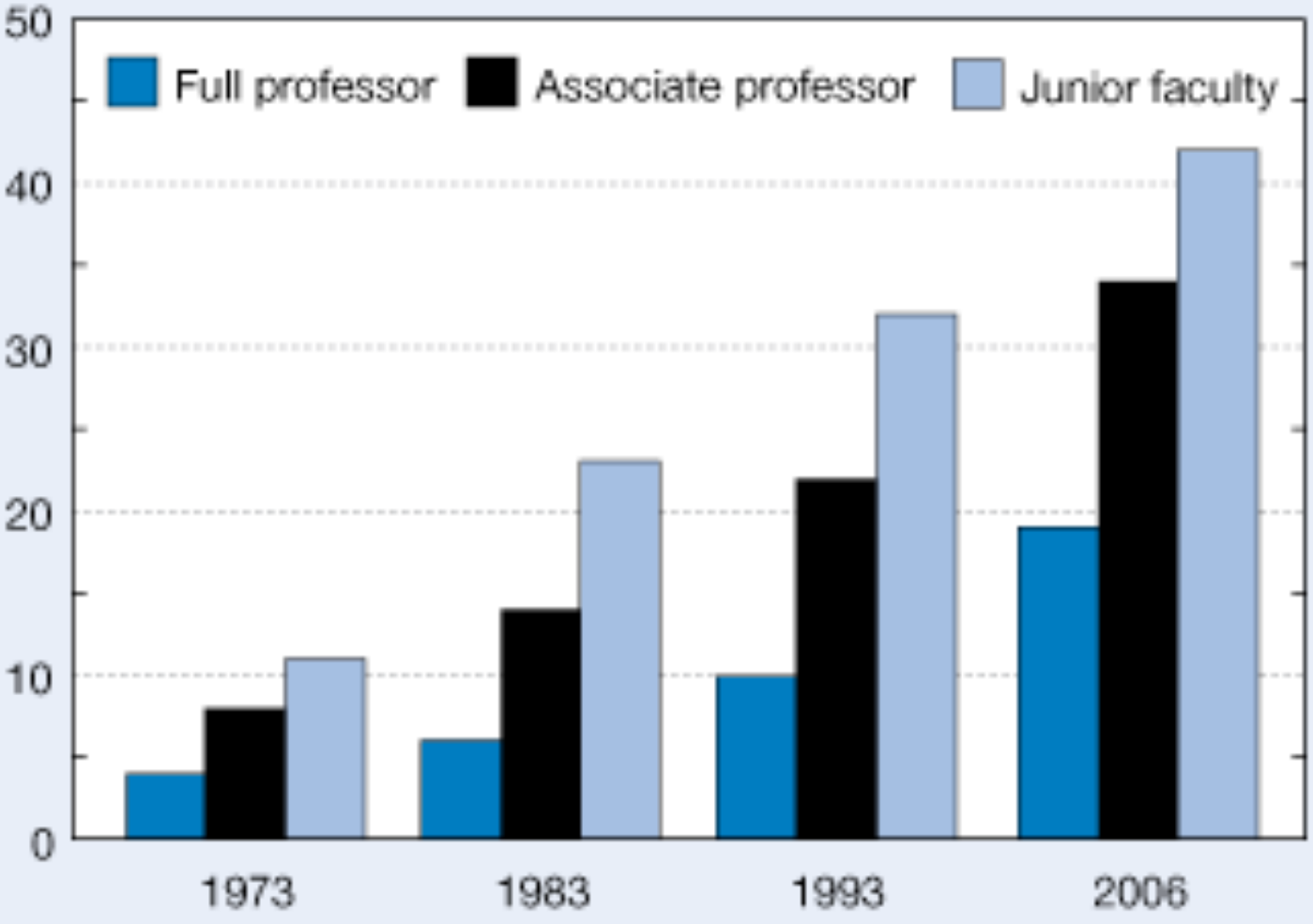
Science and Engineering Indicators 2008

Some Statistics

- 94 percent of full professors in science and engineering are white; 90 percent are male.
- 91 percent of the full professors at research universities are white; 75 percent are male.
- 87 percent of the full-time faculty members in the United States are white; 64 percent are male.
- Only 5 percent of the full professors in the U.S. are black, Hispanic, or Native American.
- The gap between the percentage of tenured men and the percentage of tenured women has not changed in 30 years.

Trower and Chait, Harvard University Mag. (March-April, 2002)

Share of doctoral S&E faculty positions held by women, by rank: Selected years, 1973–2006



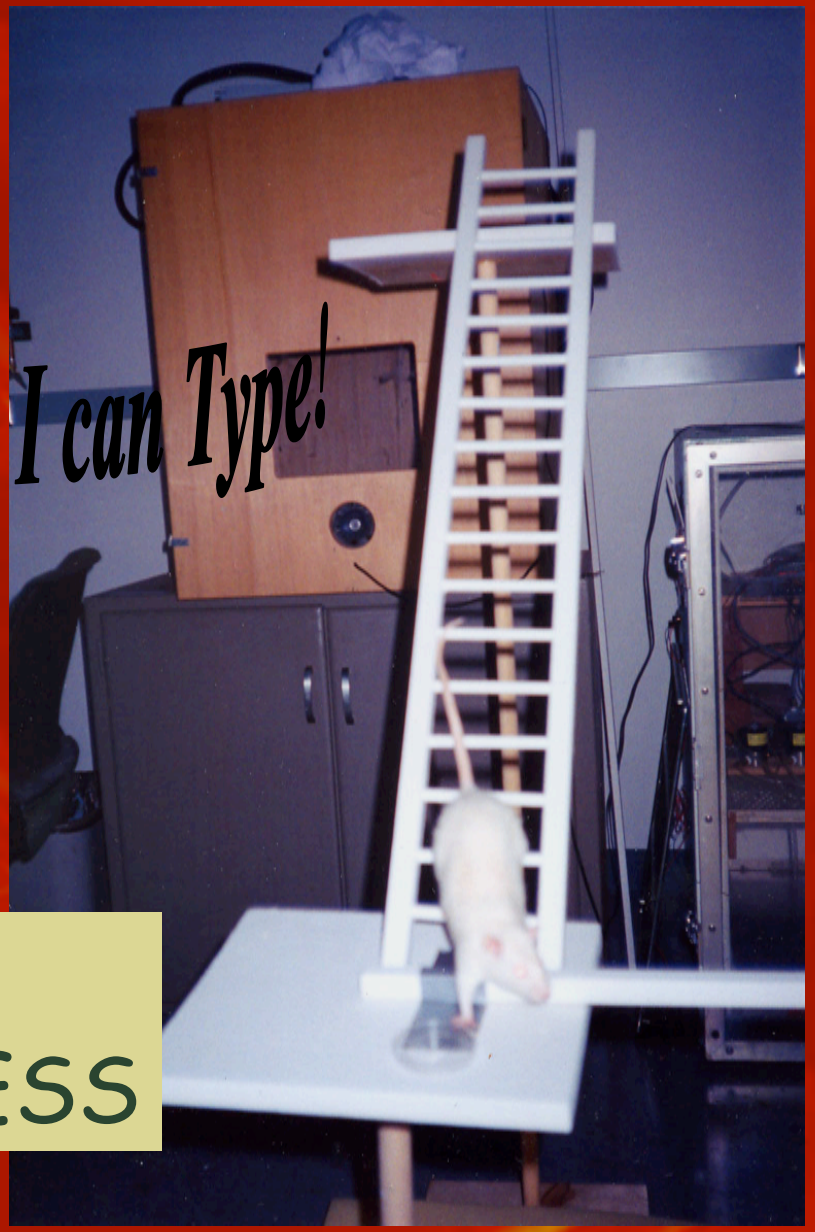
NOTE: Junior faculty includes assistant professors and instructors.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Doctorate Recipients, special tabulations (preliminary data for 2006).

Science and Engineering Indicators 2008

Why Can't we Break Out of the Maze?

MY EXODUS and Yes, I can Type!



One Path at a Time
WE HAVE MADE PROGRESS

Interesting Statistics Comparing 30 yrs

- Women currently represent 36% of full-time faculty compared to 23% in the early 1970s.
- Women constitute only 25% of the full-time faculty at research universities, versus 10 % in 1970.
- Faculty of color remain a very small part of the professoriate. (Whites constituted 95% of all faculty members in 1972 and 83% in 1997.)
  - 4.4% in 1975 and 5 percent in 1997--and almost half of all Black faculty teach at historically black colleges.
  - 1.4% in 1975 to 2.8% in 1997 for Hispanic faculty.
- While a popular explanation of the problem holds that there are insufficient numbers of women and minorities on the pathway from graduate student to faculty member. Academics label this the "pipeline problem."
  - true for minorities
  - false for women.

Source: Nelson & Rogers, 2004. A National Analysis of Diversity in Science and Engineering Faculty at Research Universities

RESEARCHERS IN HIGHER EDUCATION IN EUROPE (% FEMALE)*

	Natural sciences	Engineering and technology
Portugal	48	29
Ireland	44	25
U.K.	31	14
Italy	31	13
Finland	29	19
Sweden	29	18
France	29	17
Denmark	23	13
Austria	18	9
Germany	14	9
Belgium	11	2
The Netherlands	8	6

Source: European Commission, Eurostat

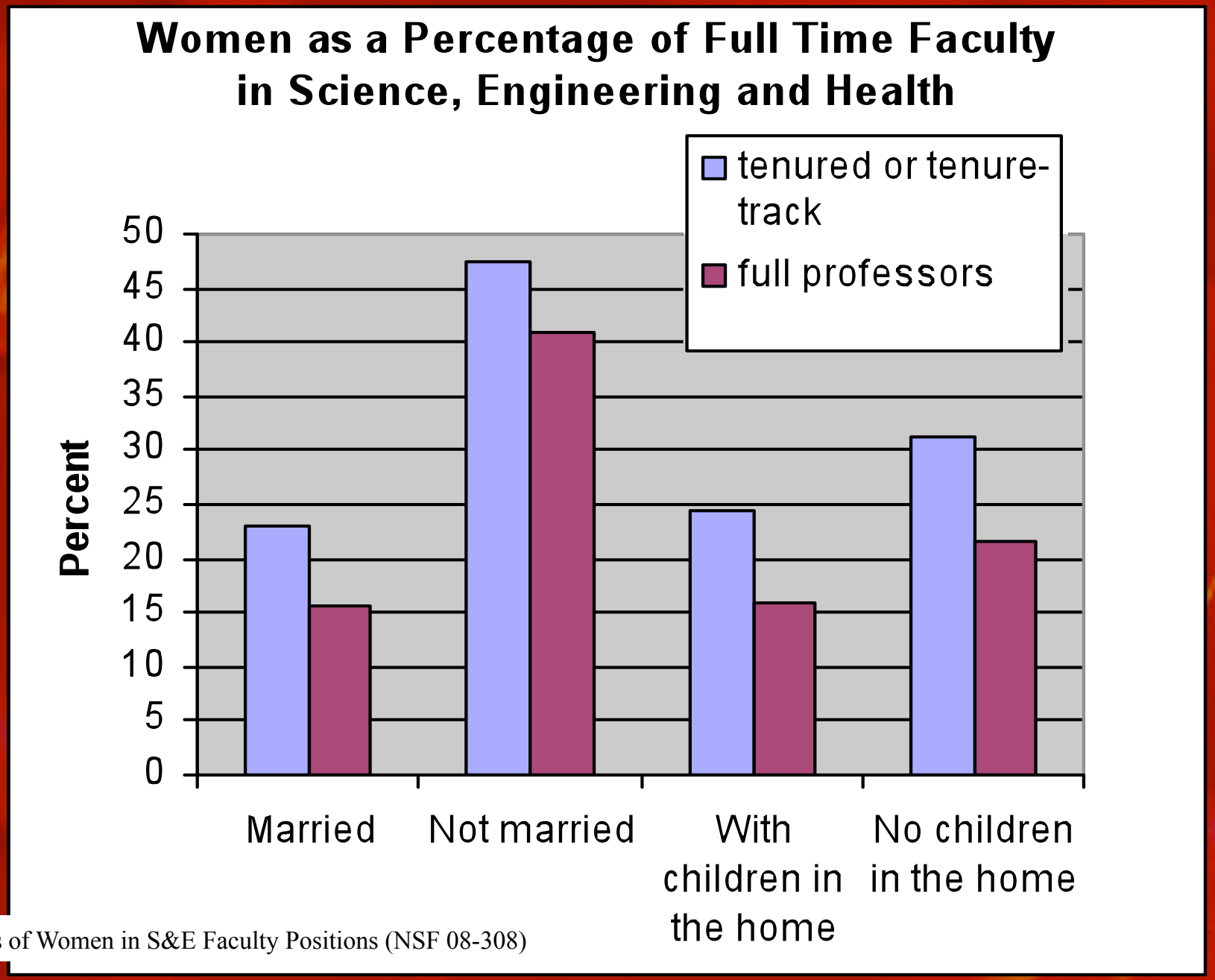
* Data from late 1990s.

Why Can't we Break Out of the Maze?

Questions no longer asked????

One Path at a Time
WE HAVE MADE PROGRESS

Effect of Marital Status and Children



Source: 33 Years of Women in S&E Faculty Positions (NSF 08-308)

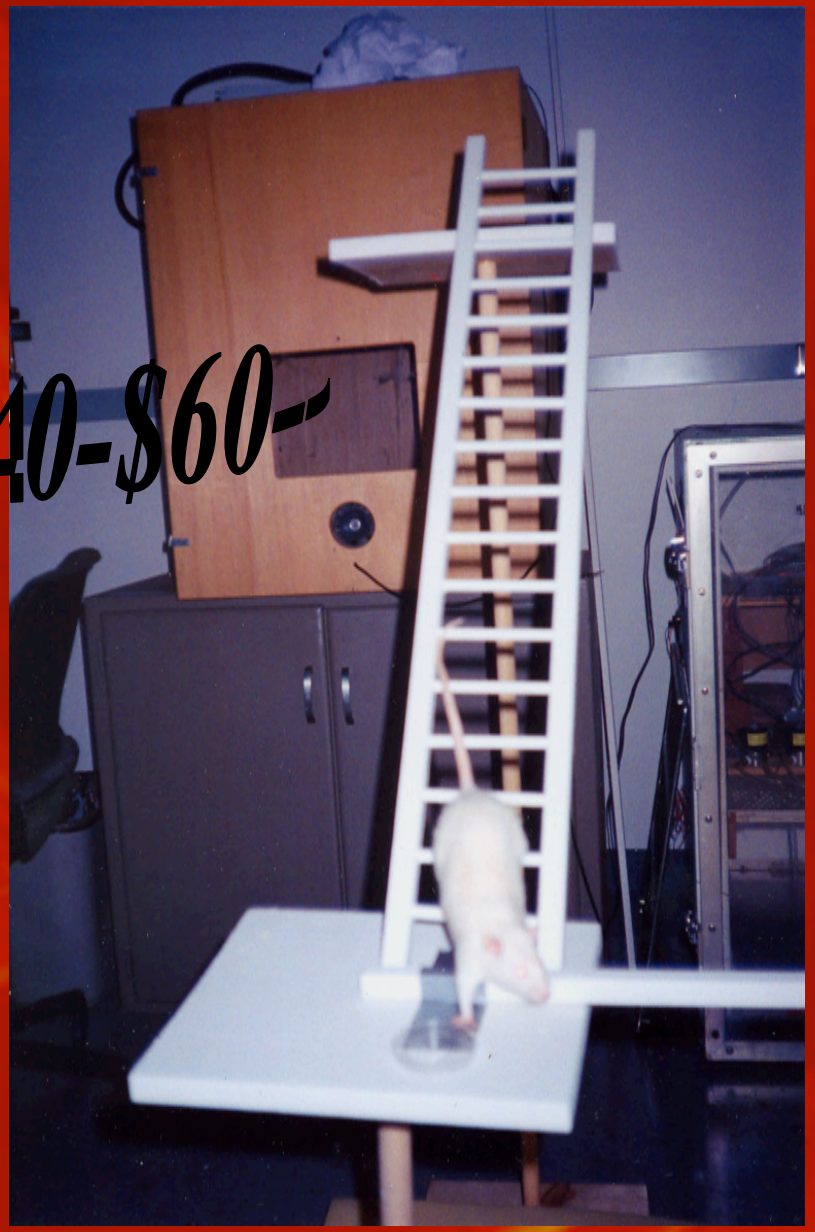
Of Note – Children and Careers

NSF Earth Sciences Postdoctoral Fellowships Program (revision announced 10-7-09)

- Award information includes the statement that Fellows may request a no-cost extension for parental leave for the birth or adoption of children.
- Award information includes a statement that Fellows may request to use two months of their stipend for paid parental leave.

Why Can't we Break Out of the Maze?

$16,000-$20-$40-$60-



One Path at a Time

$alary

Table 3-13

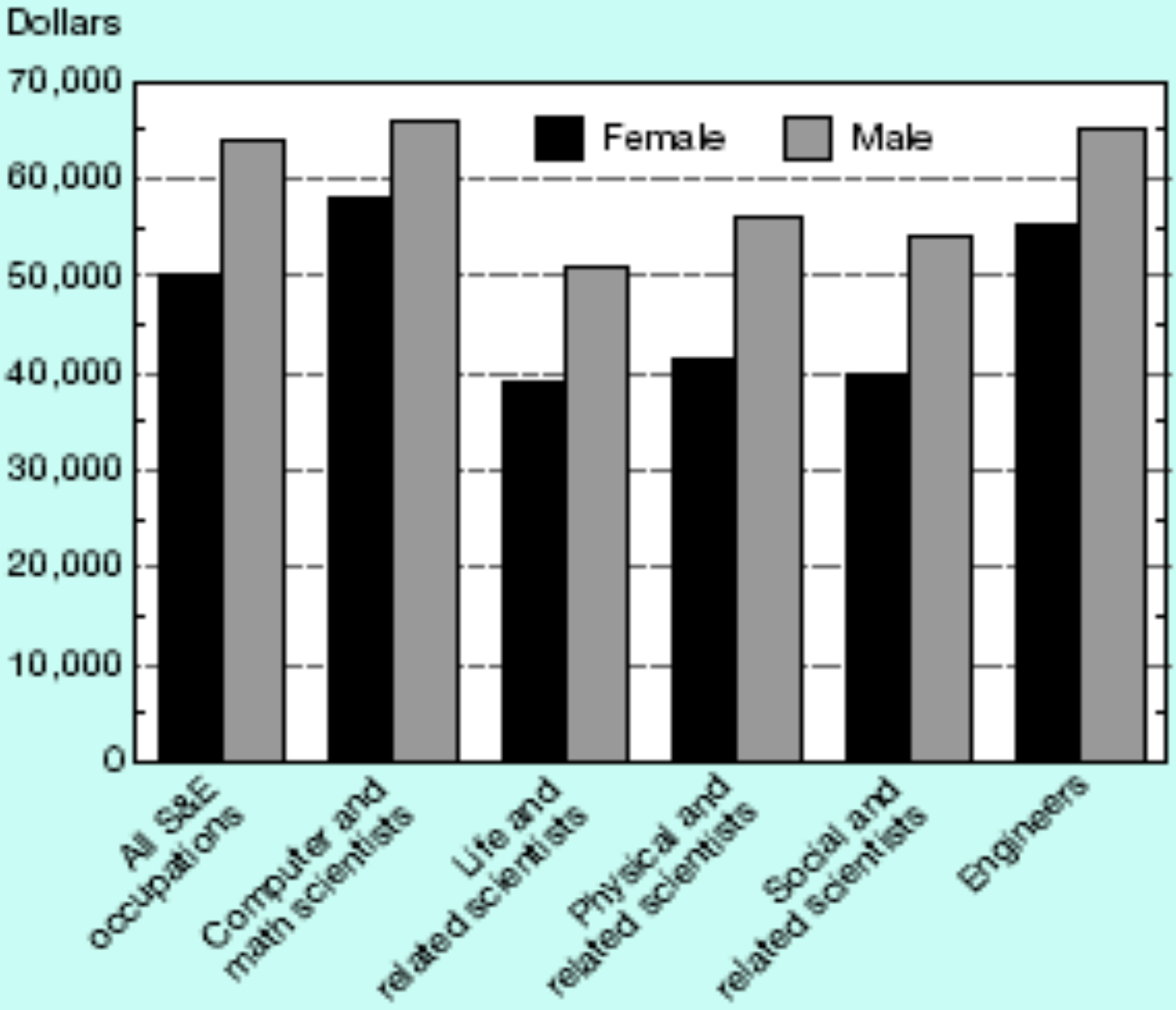
Median annual salary of individuals in S&E occupations, by sex, race/ethnicity, and visa status: Selected years, 1993–2003

(Dollars)

Characteristic	1993	1995	1997	1999	2003
S&E employed	48,000	50,000	55,000	60,000	66,000
Male	50,000	52,000	58,000	64,000	70,000
Female	40,000	42,000	47,000	50,000	53,000
White	48,000	50,500	55,000	61,000	67,000
Asian/Pacific Islander	48,000	50,000	55,000	62,000	70,000
Black	40,000	45,000	48,000	53,000	58,000
Hispanic	43,000	47,000	50,000	55,000	60,000
Temporary residents	43,300	49,700	49,000	52,000	60,000

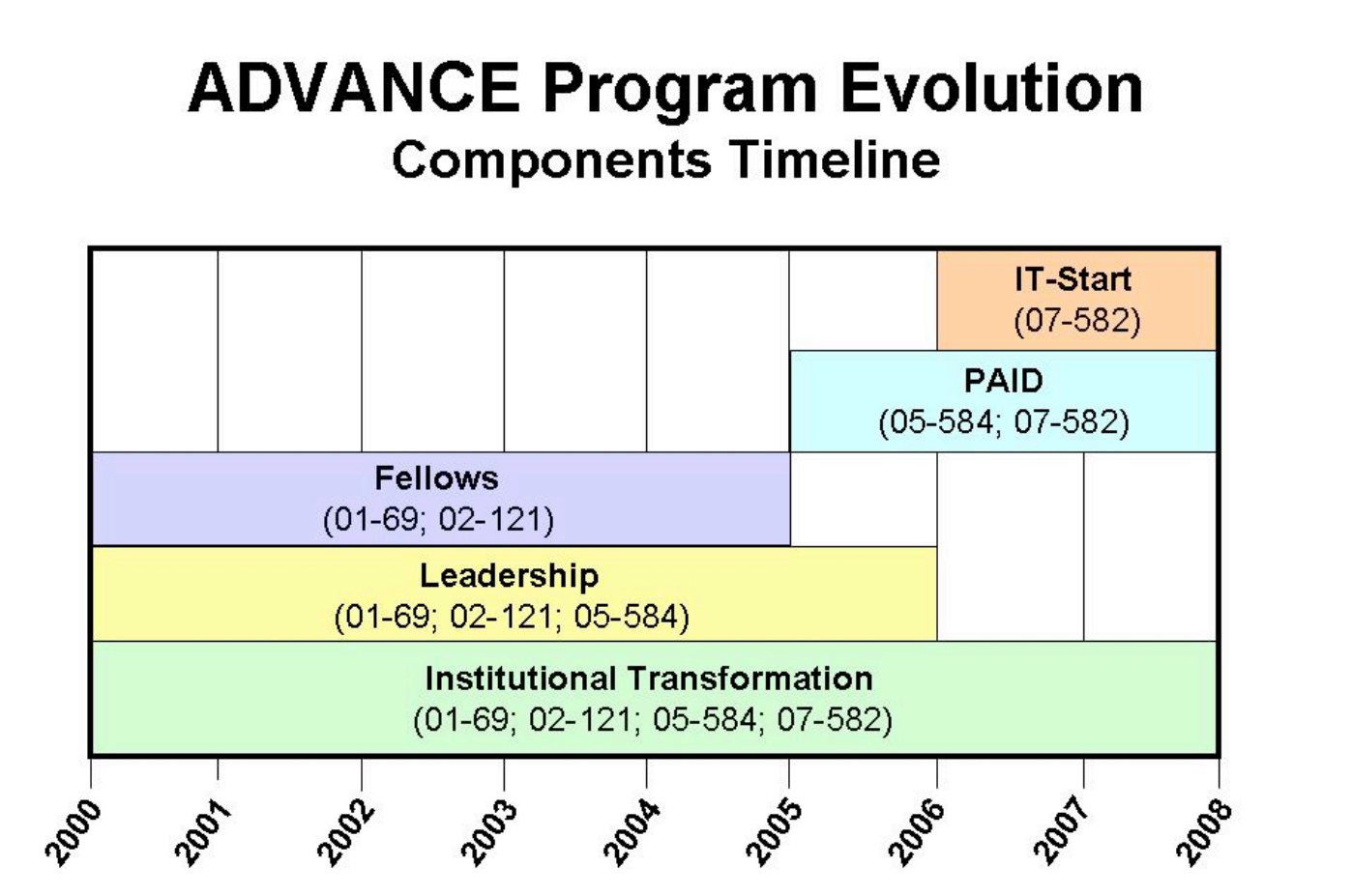
NOTE: 2003 data includes some individuals with multiple races in each category.
SOURCE: National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT), 1993–2003, http://sestat.nsf.gov.
Science and Engineering Indicators 2008

Median annual salaries of employed scientists and engineers, by broad occupation and sex: 1999



ADVANCE; Why do we need it?

- Program Goal: Increase the participation and advancement of women at all levels in academic science and engineering careers.
- Since 2000 … Are we there yet?

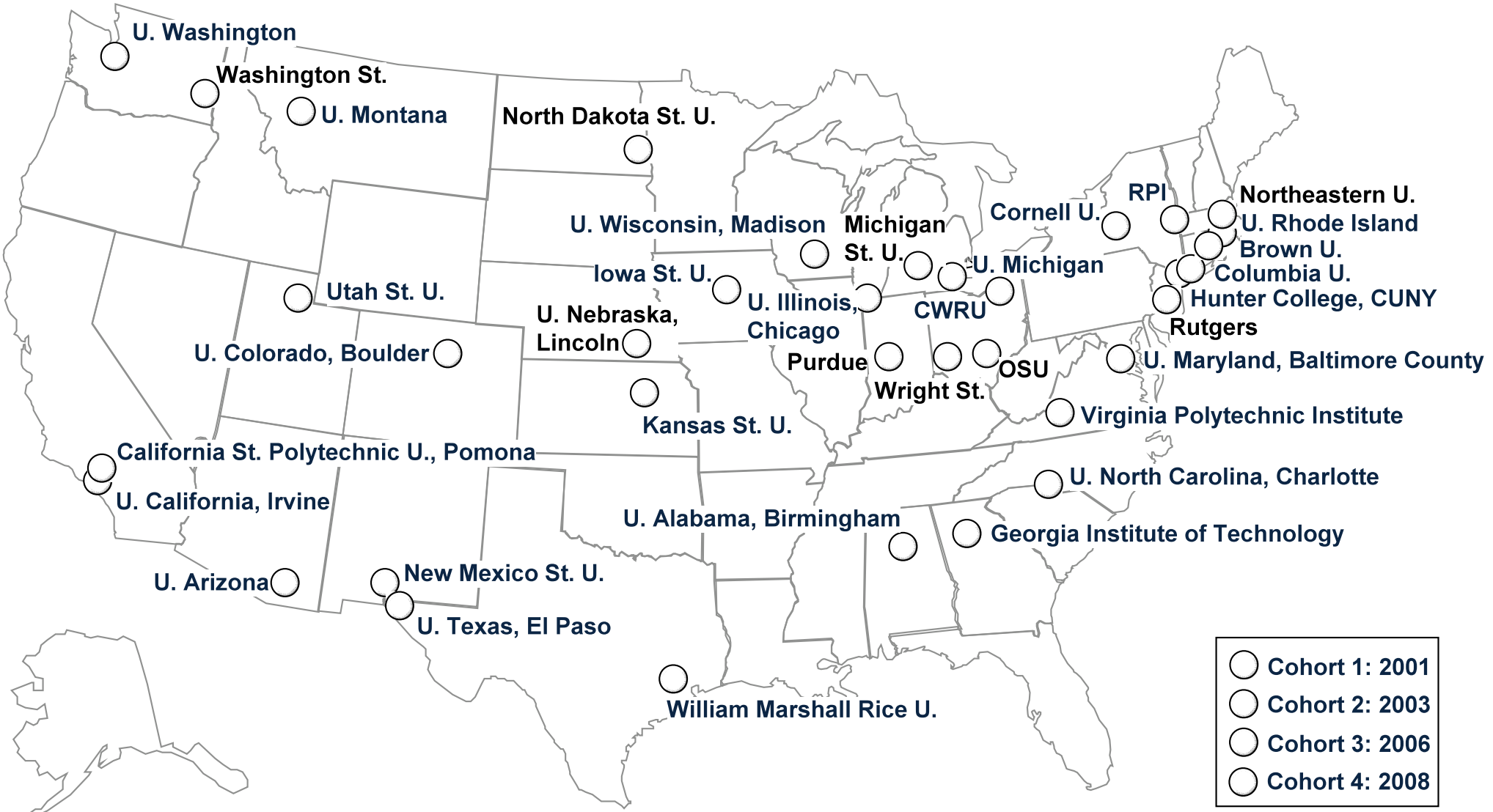


NSF ADVANCE Program

Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers

- Three program levels
  - Institutional Transformation (IT)
    - "The big one": Comprehensive, institution-wide change!
    - $2 M to $5 M total over 5 years
  - Institutional Transformation Catalyst (IT-Catalyst)
    - Early planning and assessment activities to prepare for transformational activities
    - $100 K to $200 K total for 2 years
  - ADVANCE-PAID
    - Helps institutions adopt successful practices demonstrated by other institutions
    - One year to five year projects; funding depends on the scope of the project
- Awards made every two years

ADVANCE Institutional Transformation Grantees 2001-2008

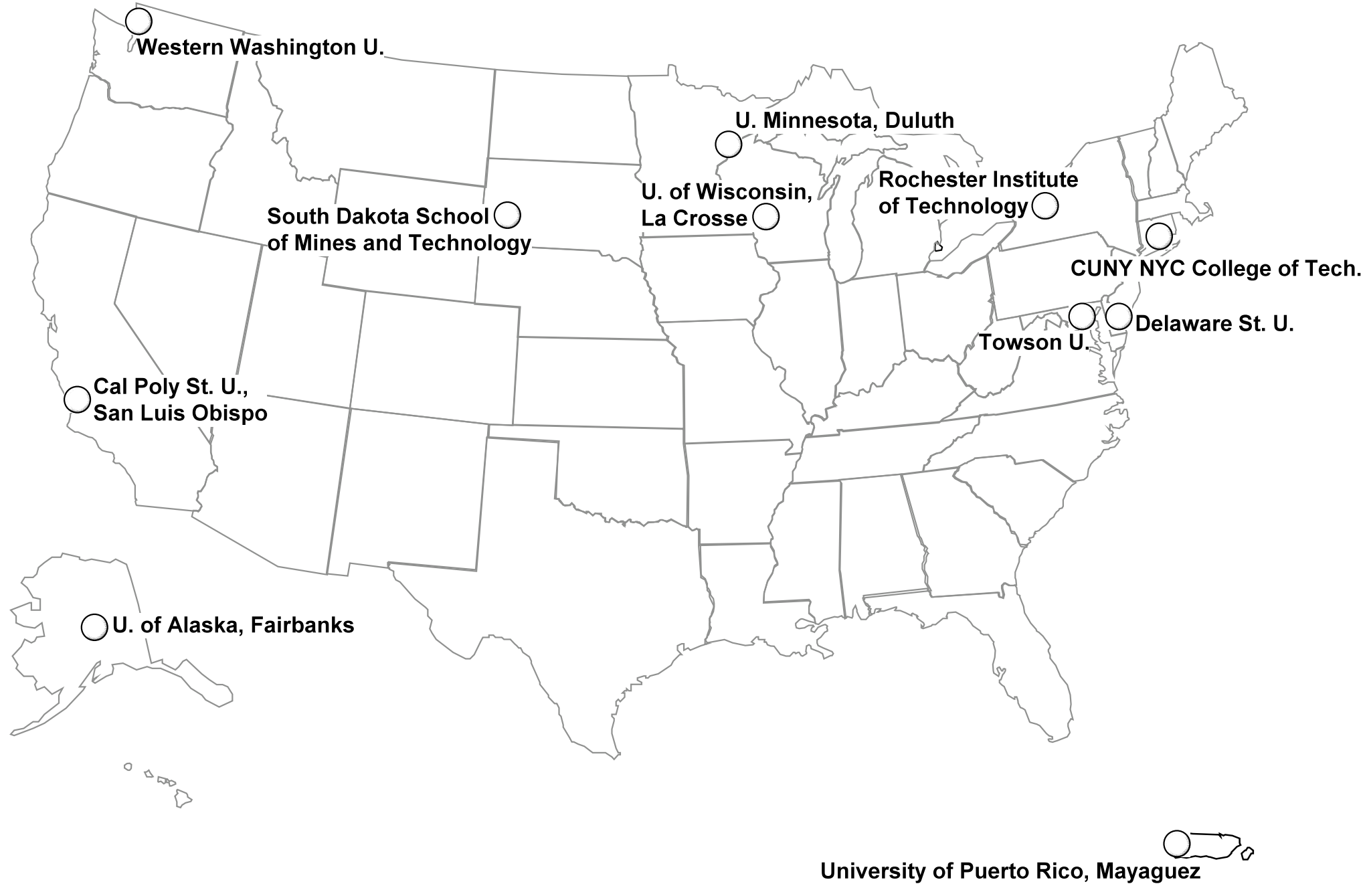


Small IT awards to promote promising practices:

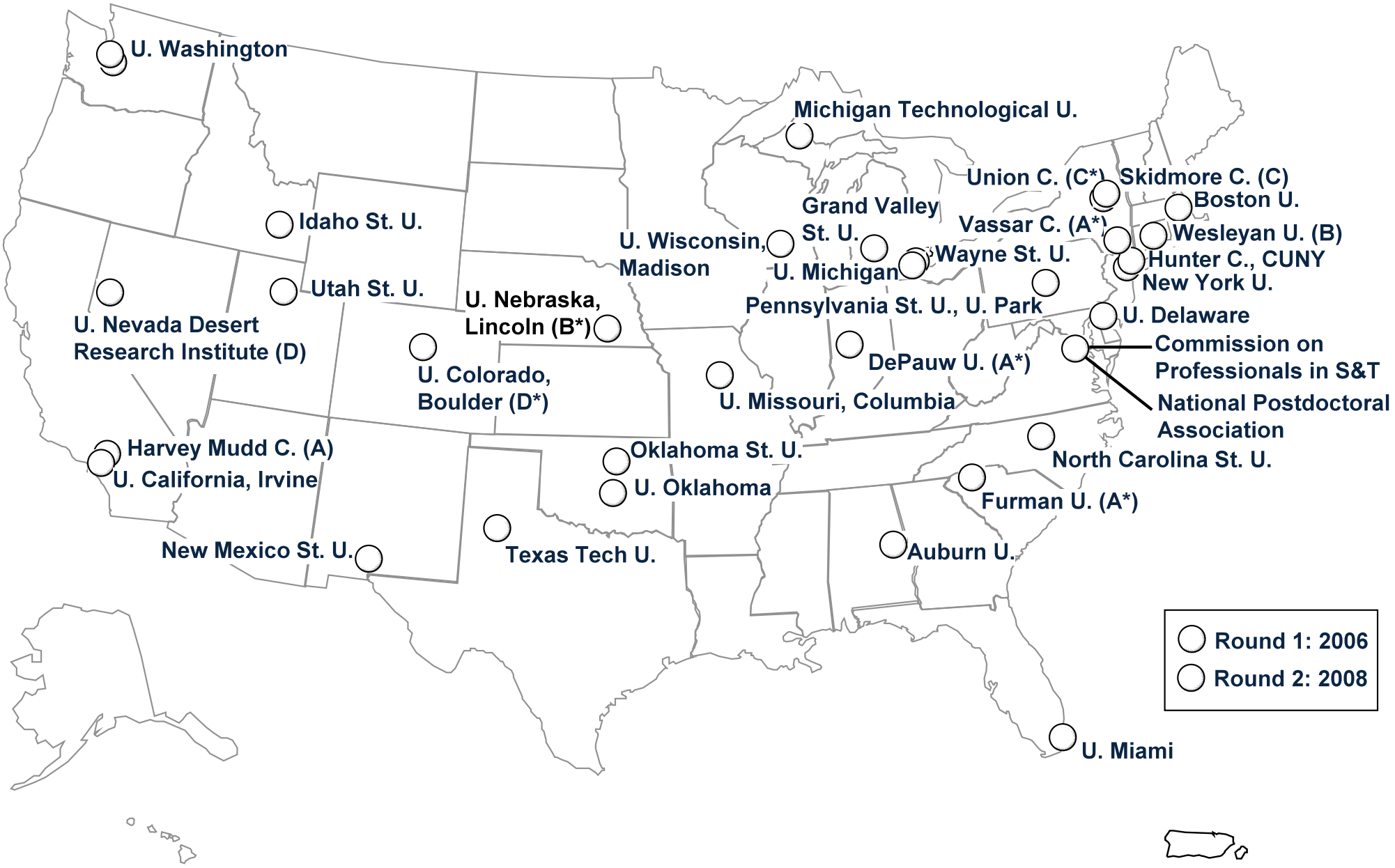
- Duke University
- Marshall University
- New Jersey Institute of Technology
- University of Maryland, Eastern Shore

U. Puerto Rico, Humacao

IT-Catalyst 2008 Grantees



PAID Grantees: 2006-2008



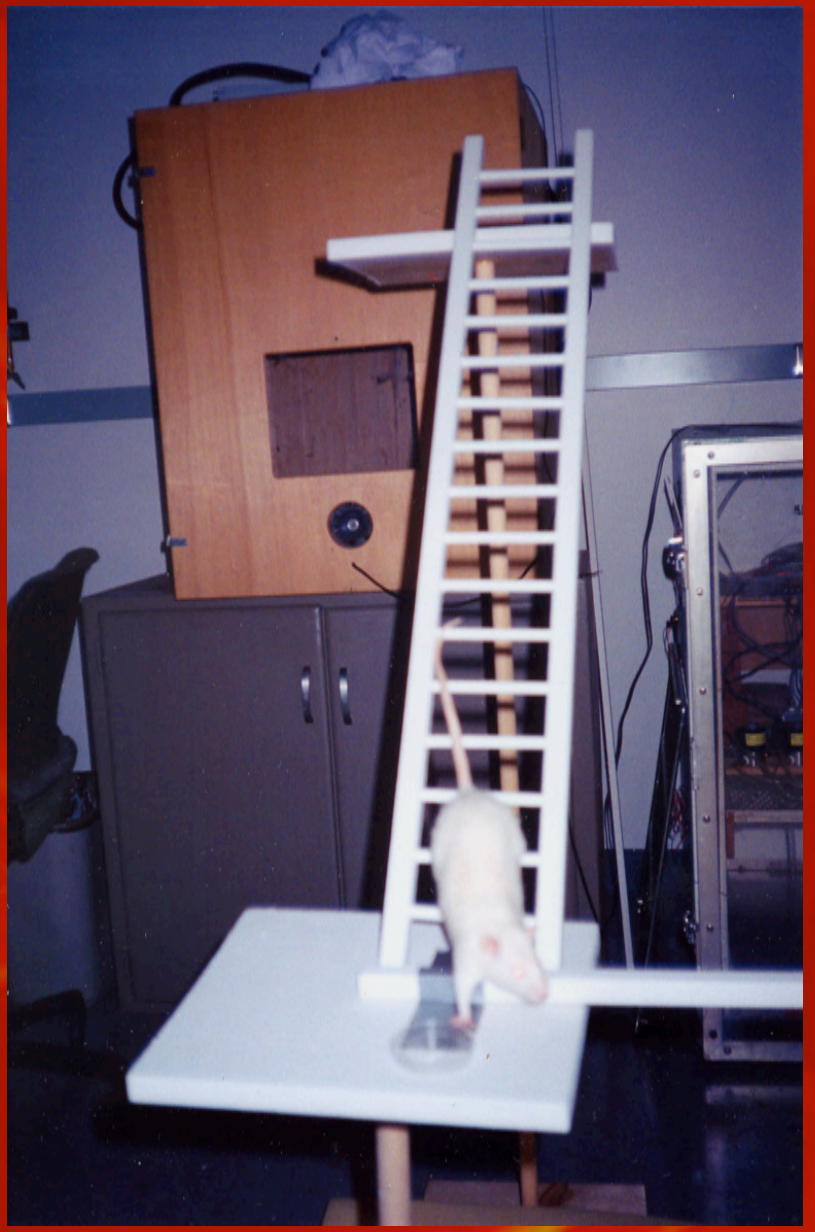
NIH Women in Biomedical Careers Initiative

- Funding 14 grants focusing on factors that influence the careers of women in biomedical and behavioral science and engineering (Oct 2009)
- Influences on women's career choices: family and economic factors, institutional environments, and broader social and cultural issues
- Role mentoring and funding support throughout women's academic careers
- Impact of family-friendly policies on retention
- Underrepresented and financially disadvantaged women also examined

(Breaking the Glass Ceiling)

- Catalyst Study (1996): Survey of 1251 executive women who hold titles of vice president or above in Fortune 1000 companies - **Most Effective Strategies for Overcoming Workplace Barriers**
- #1 Strategy: Consistently exceed performance expectations
- #2: **Develop style that men are comfortable with**
- #3: Seek difficult or high-visibility assignments
- #4: Have an influential mentor
- …

Why Can't we Break Out of the Maze?

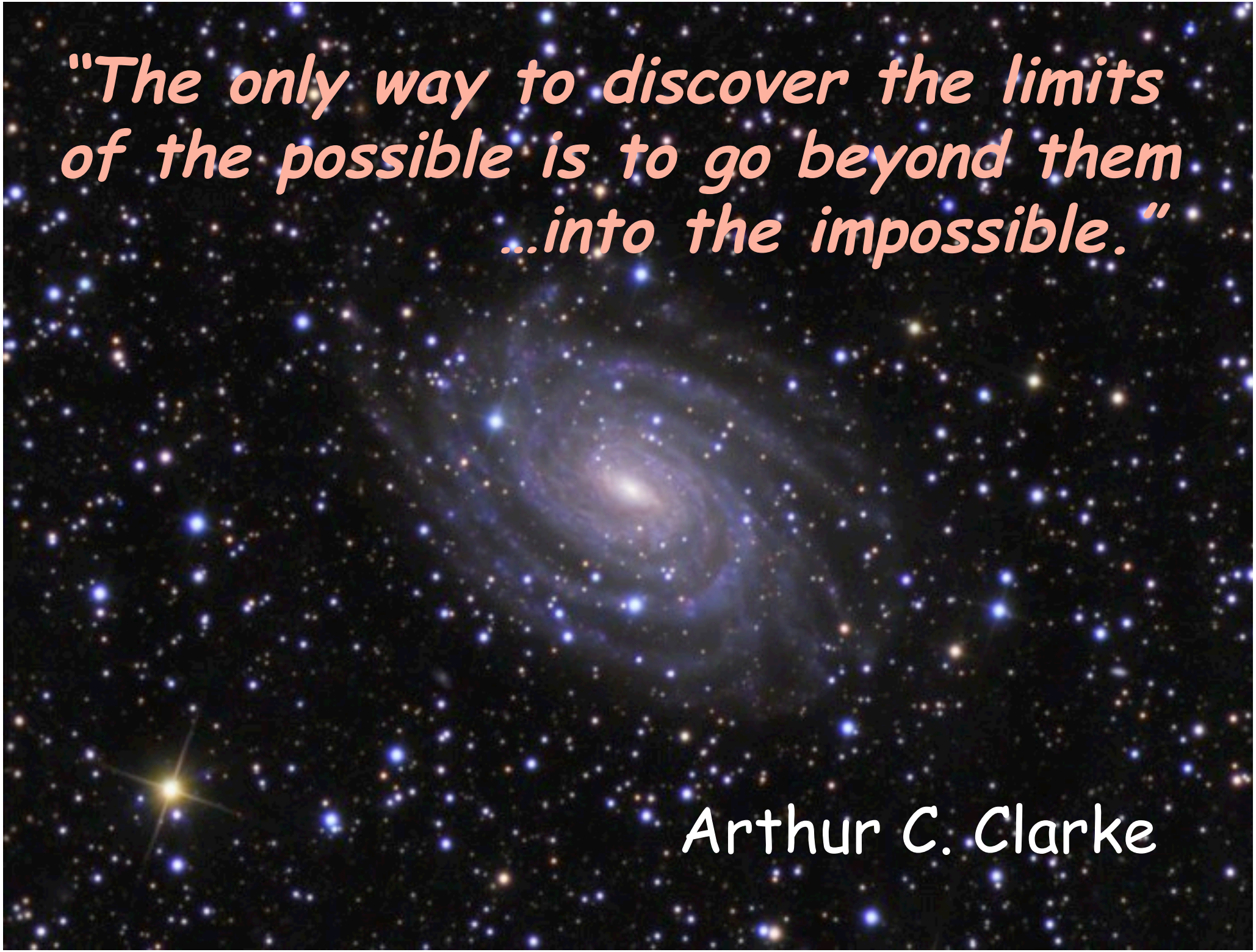


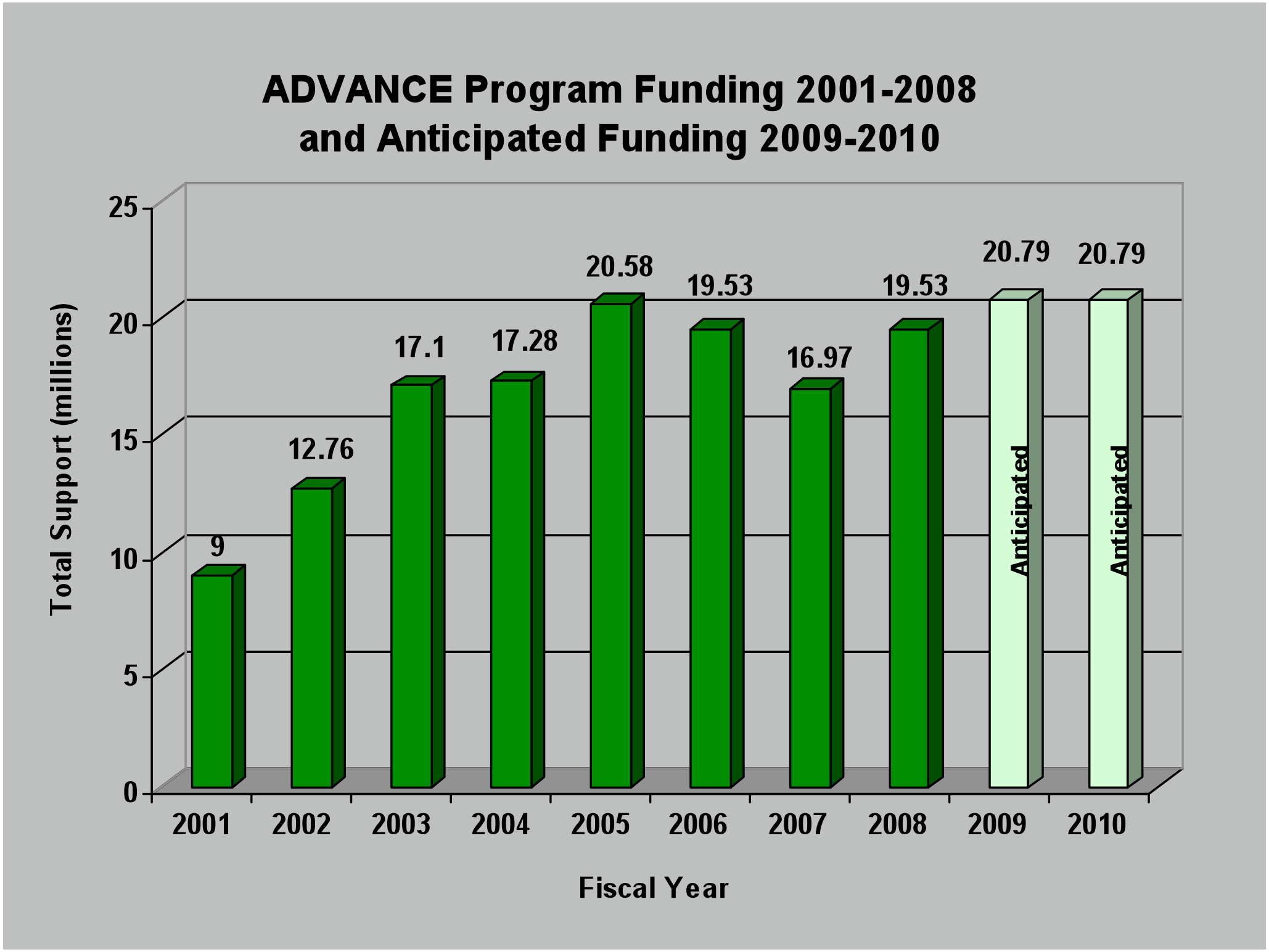
One Path at a Time

Enhance Visibility for Women Scientists and Engineers

- Enhance visibility through Presidential events
  - The Presidential Award for Excellence in Science, Math, and Engineering Mentoring (PAESMEM) **
    - recognize outstanding mentoring efforts/programs designed to enhance the participation of underrepresented groups
  - Presidential Early Career Award for Beginning Scientists and Engineers (PCASE)
  - Presidential Medal of Science (U.S. Nobel!)**
  - Waterman Award **
  - ** if you don't nominate!!!


YOU ARE HERE


"The only way to discover the limits
of the possible is to go beyond them
...into the impossible."
Arthur C. Clarke


ADVANCE Program Funding 2001-2008
and Anticipated Funding 2009-2010
Total Support (millions)
25
20
15
10
5
0
9
12.76
17.1
17.28
20.58
19.53
16.97
19.53
20.79
20.79
Anticipated
Anticipated
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Fiscal Year

Program Management

ADVANCE is a "NSF-wide" program

- The Assistant Directors (ADs) of each participating directorate reviews and approves the program solicitation and management plan
- Program funds are located in the participating directorates and offices

ADVANCE Implementation Committee (AIC)

- One or more representatives from each participating Directorate and Office
- Acts as an advisory committee
- Meets monthly to discuss program management and related issues

NSF EHR: Innovation through Institutional Integration – I^3

Goals of I^3:

- Creative integration of NSF awards
- Increase synergy and collaboration across NSF-funded projects and within/ between institutions
- Expand and deepen the footprints of NSF-funded projects and enhance their sustainability